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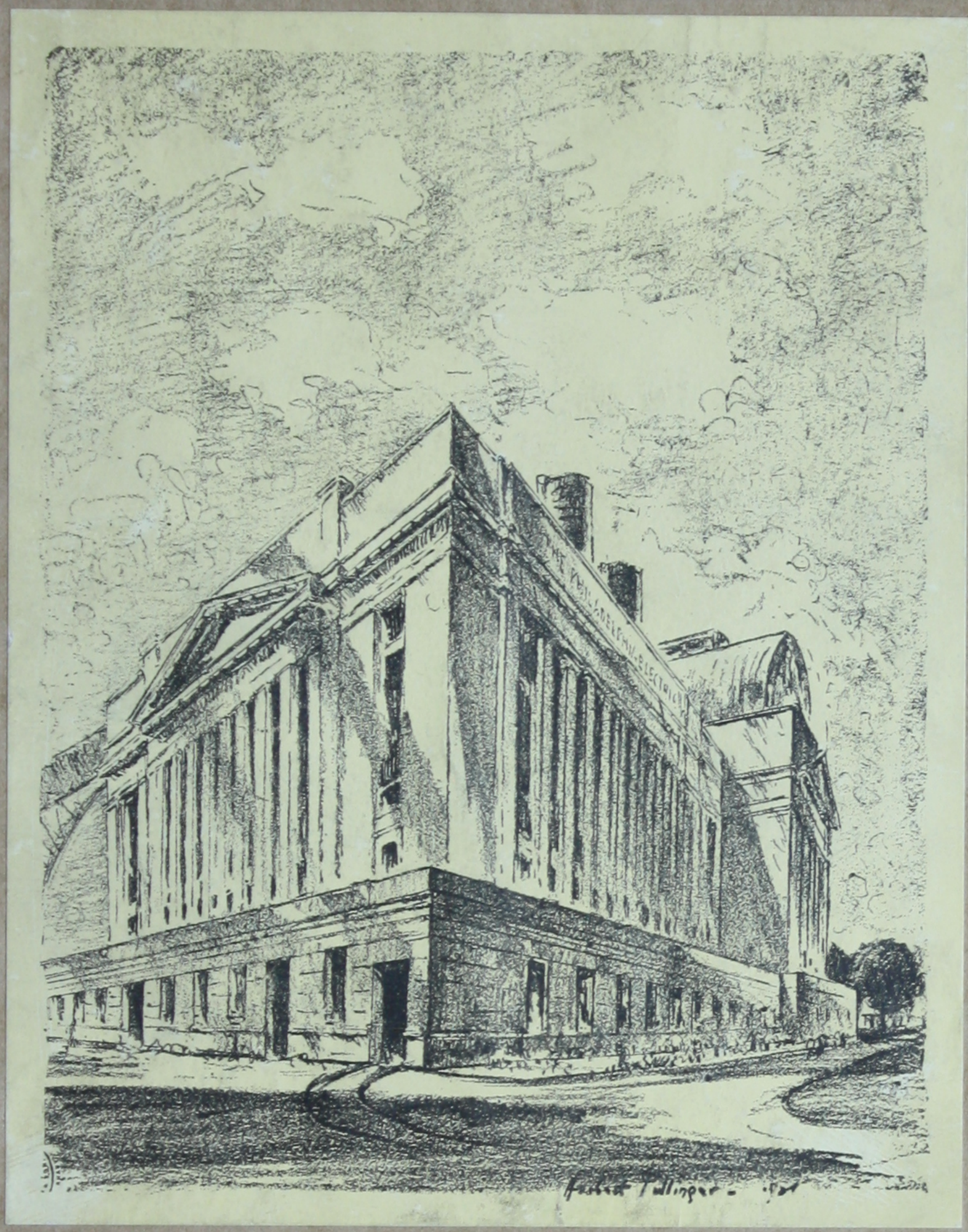


Richmond Station

OF

The PHILADELPHIA ELECTRIC COMPANY SYSTEM

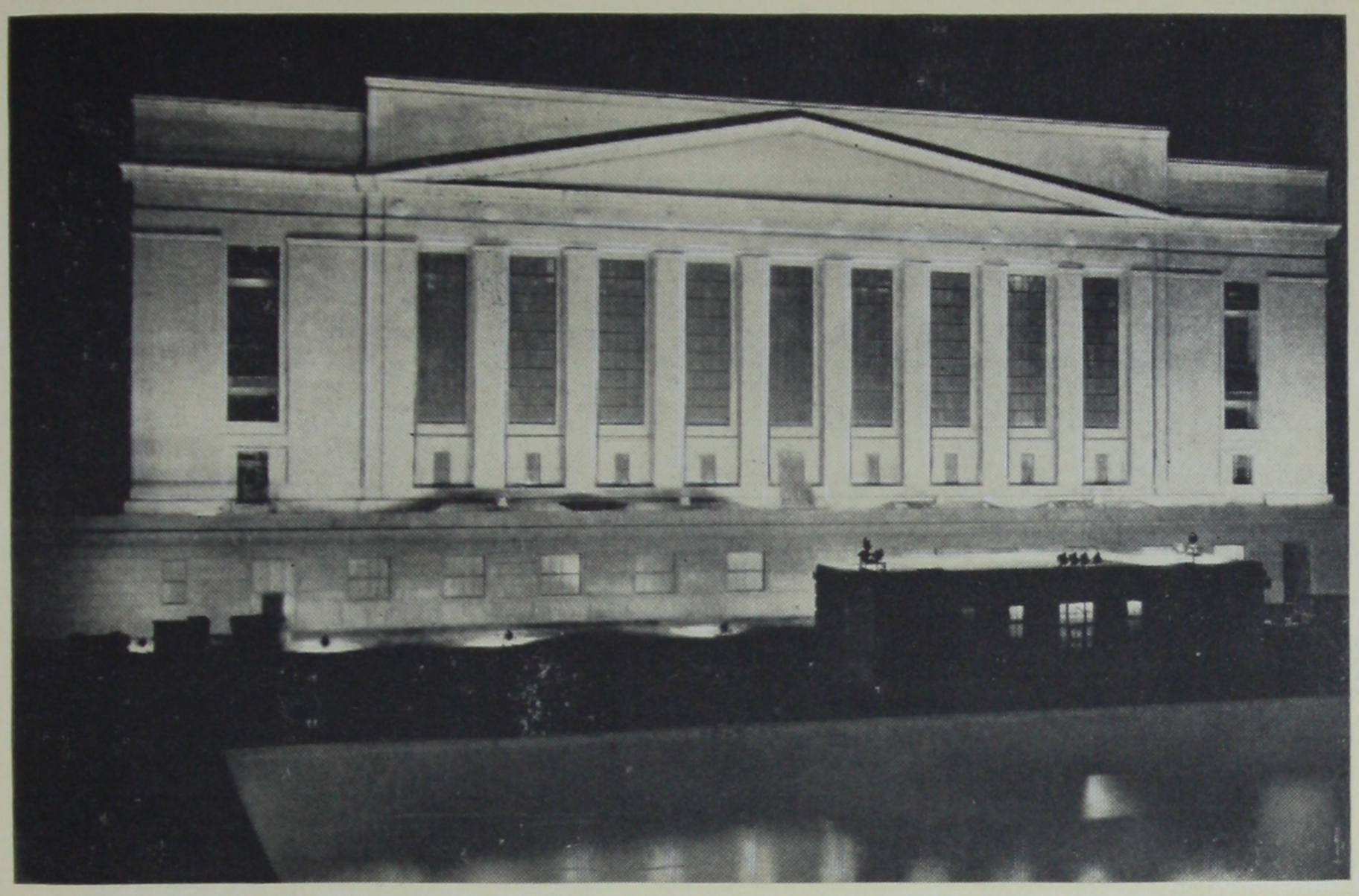
Richmond Station

THE PHILADELPHIA
ELECTRIC COMPANY
SYSTEM
Philadelphia, Pa.

Etchings by Herbert Pullinger
Photographs by The Philadelphia Electric Company

MAY, 1926

The first unit of Richmond Station as it appears from an aeroplane. The completed station will consist of three of these units.



Bathed in the soft radiance of cleverly placed floodlights, the river facade of the Richmond Station at night presents a lordly and dignified mien.

BACK in 1888, which after all is not so very far back as time is counted in the electrical industry, the Edison Electric Light Company of Philadelphia—forerunner of the present Philadelphia Electric Company—ordered two generators of 2,500 lights capacity each. A most amazing step forward was this, so amazing as to be almost foolhardy, and well-known and respected engineers laughed at the idea of such large generators ever being built. Finally a conference of all the leaders of the industry was called to thresh out the matter. The endorsement of Thomas A. Edison was given to the idea and these generators were looked upon as pioneers in a new world of great electrical units.

About twenty-five years later The Philadelphia Electric Company again ordered two turbo-generators—this time again the biggest in the world. One was a 35,000 kilowatt capacity

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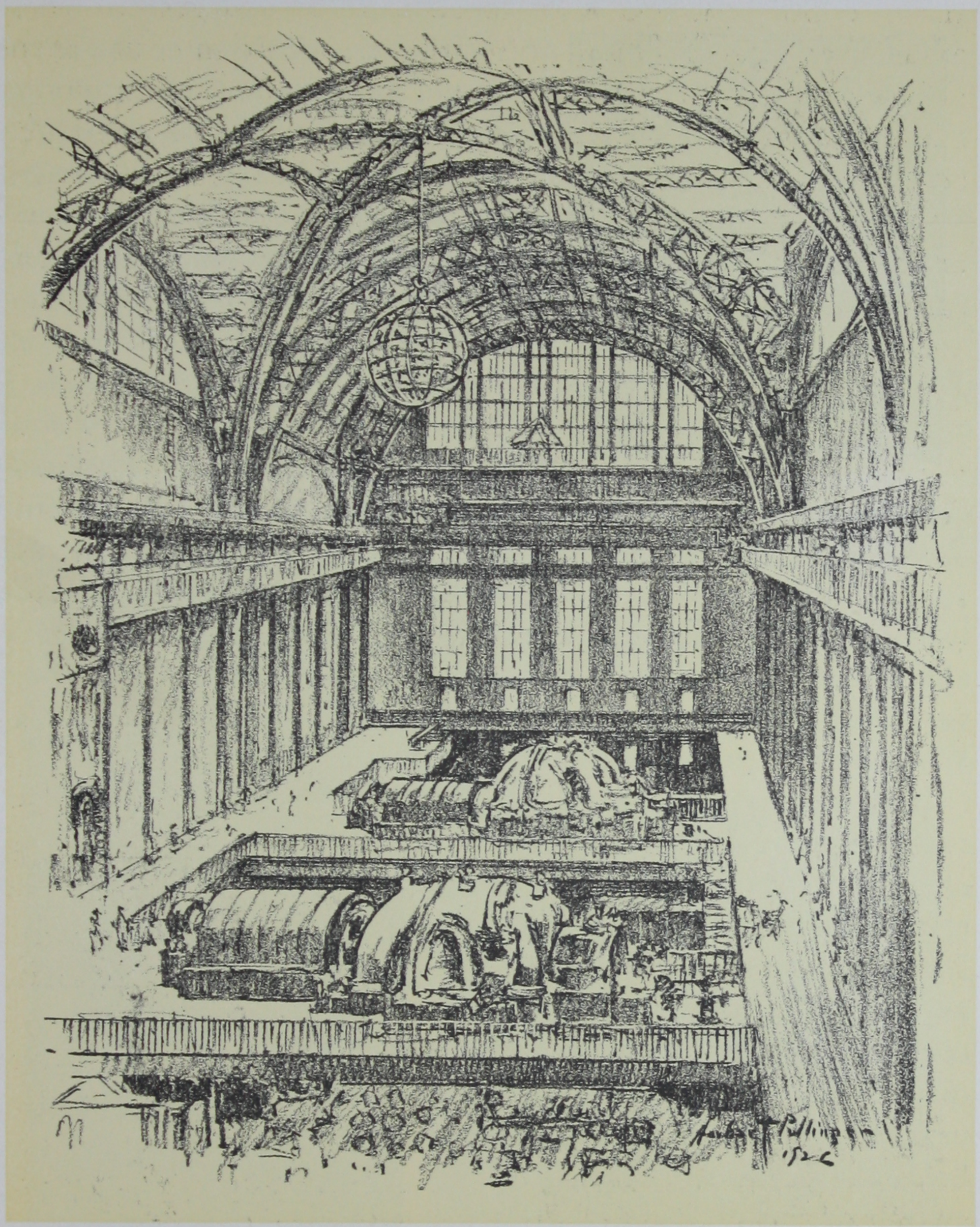
and the other 30,000 Kw. capacity. The largest of these would have made Philadelphia the center of interest of the electrical industry, but, at the thought of two such giants in one building, the entire electrical world again sat up and took notice. So in December of 1915, we said to our customers: "The largest, most complete generating station of its kind in the world is here in Philadelphia, at Twenty-eighth and Christian Streets, and the largest turbo-generators in the world are at work in it."

Much more has been accomplished in the ten years since then. Two other magnificent generating stations have been added to the system of The Philadelphia Electric Company—the Chester Station, located on the Delaware River at Chester, and Delaware Station, located also on the Delaware, at Beach and Palmer Streets, Philadelphia. As each of these stations was added to the system, it was the last word in construction, equipment and efficiency.

The coal tower at Richmond has a capacity of 650 tons per hour. Coal comes in at Port Richmond and is brought here via barge

The latest addition to The Philadelphia Electric Company System, the new Richmond Station, however, far outranks any of these previous stations. The ultimate plant will have a capacity of at least 720,000 Kw.—at the present time, the first of the three buildings has been completed. This places it in the front rank as one of the world's largest steam power stations. This first building will house four generating units of at least 60,000 Kw. capacity each. Two of these



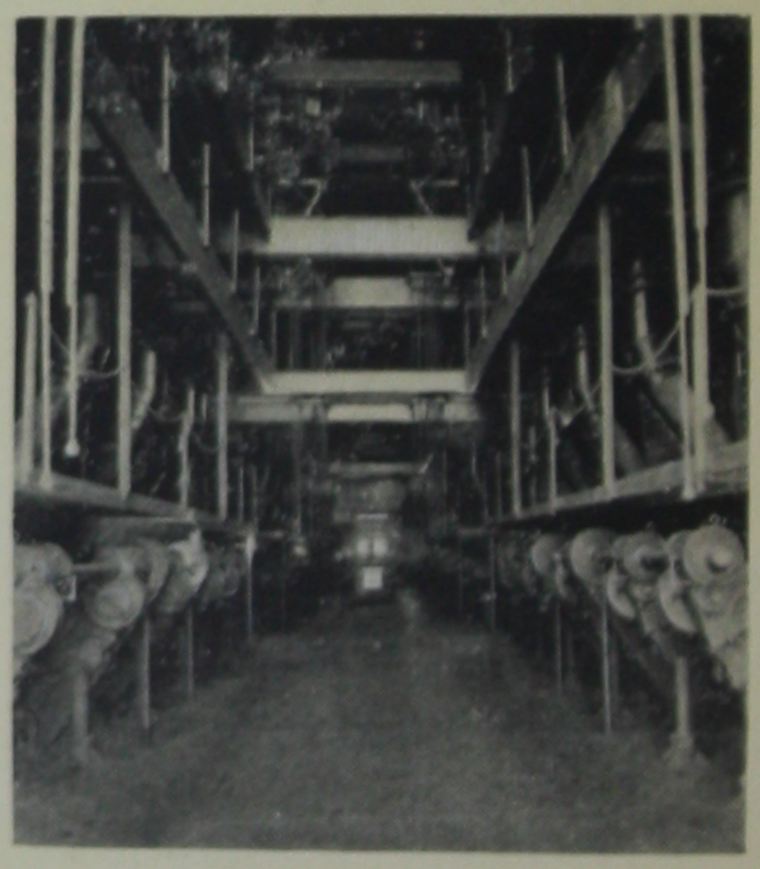
Although imposing in design and handsome in structure, the Turbine Hall at Richmond Station is remarkable chiefly because it will ultimately house four of the largest turbo-generators in the world.

Coal conveyor belts which carry the coal from the tower and drop it in the coal bunkers over the boilers.

are already in operation.

With the addition of the Richmond Station and the Conowingo Hydro-electric plant, on which work has already been started, The Philadelphia Electric Company System becomes, in effect, a super-power system within itself. Conowingo will be connected to Philadelphia with a 220,000 volt tie line—Chester is already connected to Philadelphia with a 66,000 volt tie line and Richmond will also have a 66,000 volt tie line. In this inter-connection of stations lies assurance of reliability, efficiency and economy of electric service for this city which is known variously as Philadelphia, City of Homes, and Philadelphia, Workshop of the World.

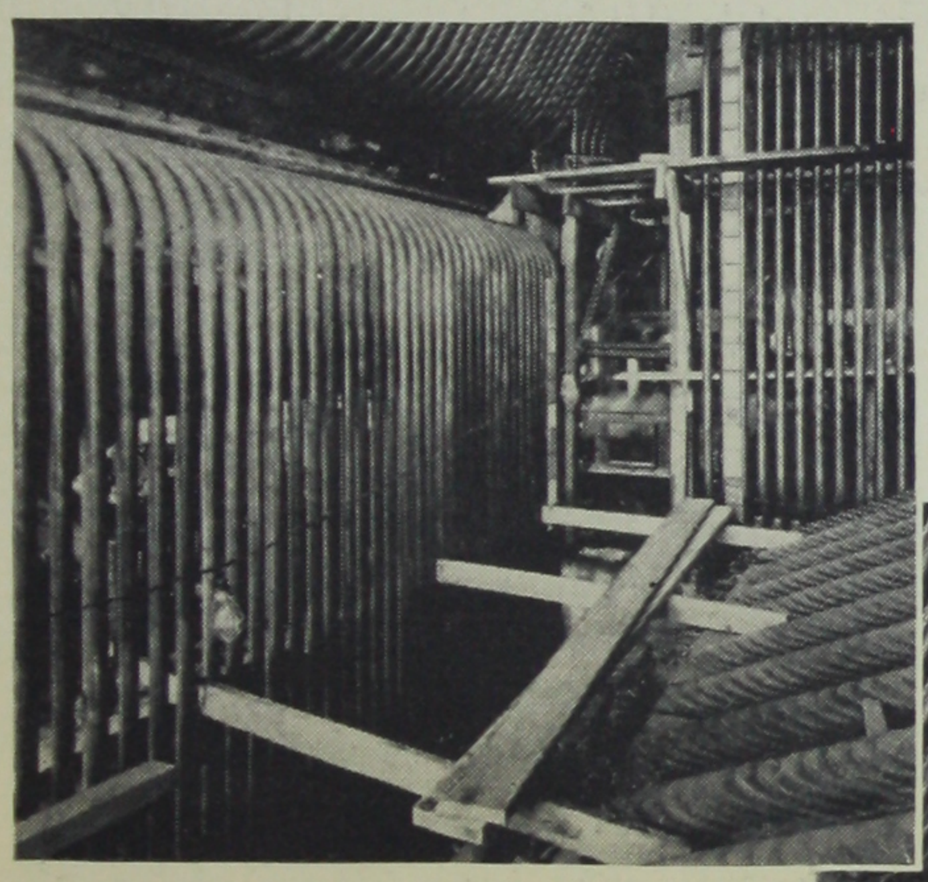
It is a unique industry—this supplying the community with electricity for light, heat, power, refrigeration and transportation. Electricity must be manufactured as demanded, for it cannot be economically stored in large quantities. No matter how unusual the demand, current must be available at the turning of a switch or the pressing of a button. Nobody knows just what electricity is, and yet here in this most modern of plants, Richmond Station, the captive giant



No laborious coal shoveling here—the automatic electric stokers feed coal to these boilers at the rate of one hundred tons per boiler per day.

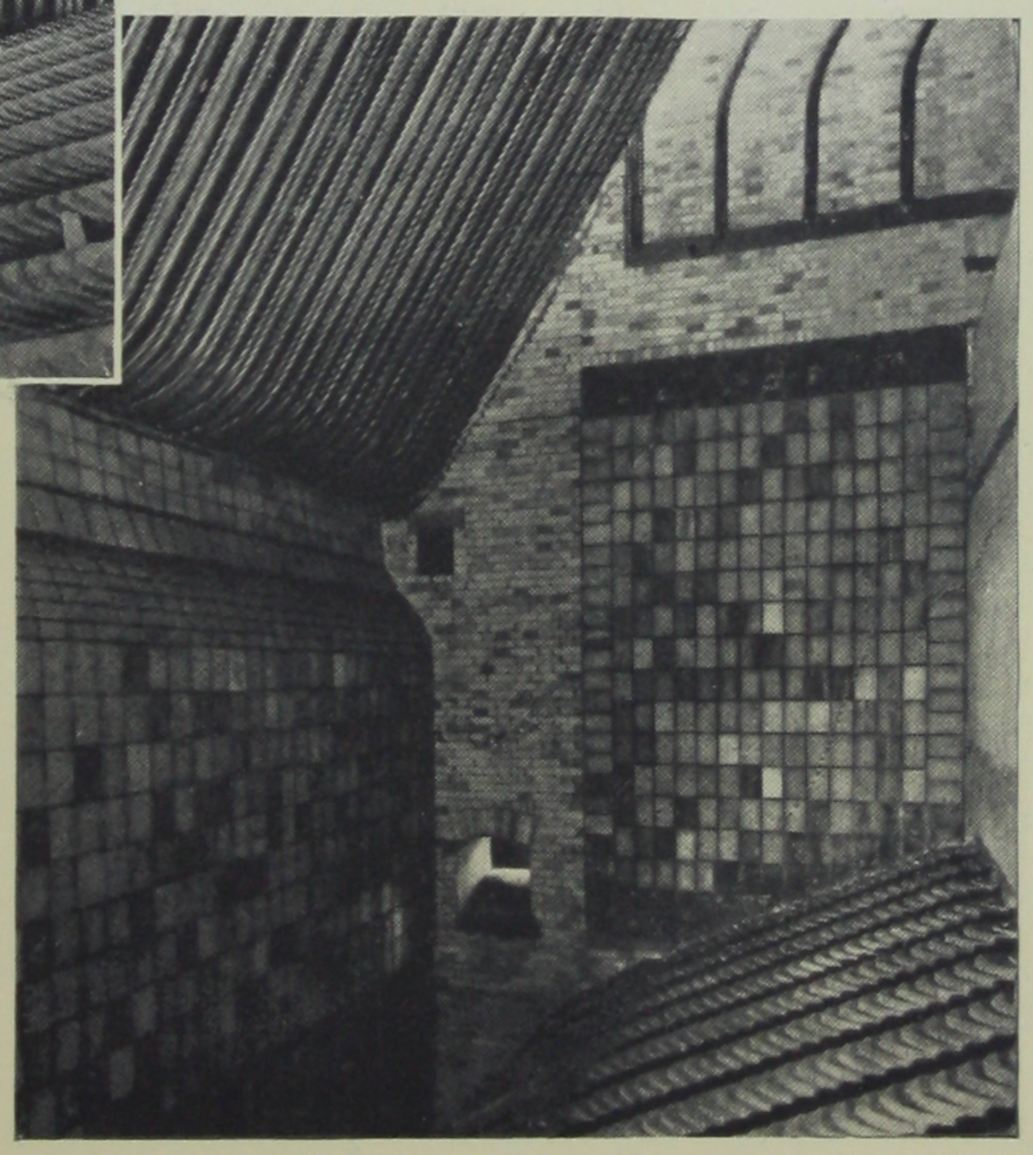
is under such marvelous and complete control, that his every emotion, his every surge of temperament, is accurately measured and recorded.

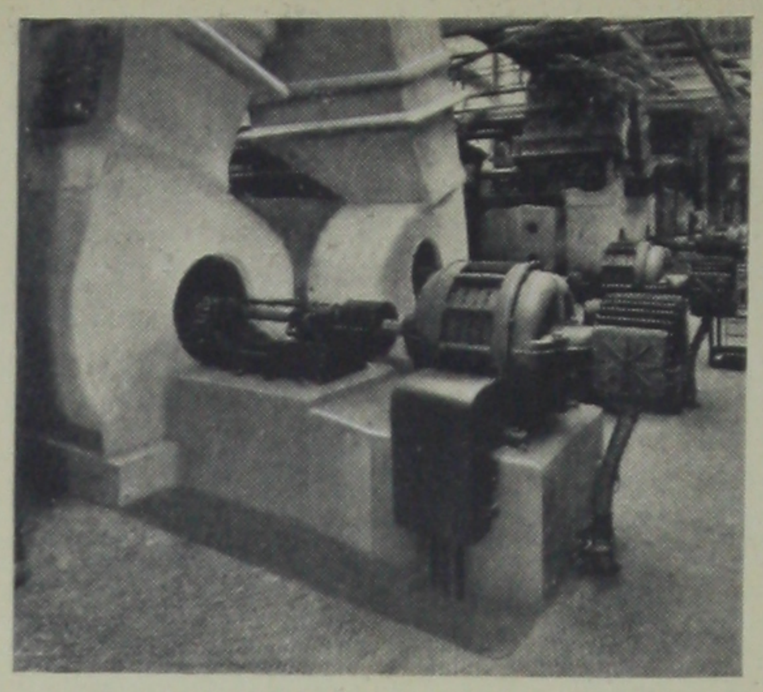
Electrical energy, like every other manufactured product, is a combination of raw materials—in this case, coal, air and water. Strictly speaking, it is not a combination of these materials in the same sense that paper, for instance, is a combination of wood, pulp and chemicals. Coal, water and air—these are the necessities for producing electricity. The Aladdin of the turbo-generator mysteriously extracts from these the energy which lights our homes, runs our cars, turns the wheels of industry and finally broadens our civilization.



This shows the inside of one of the furnaces with water cooled walls—the picture above shows the intricate system of pipes in the same furnace before they were covered with brick.

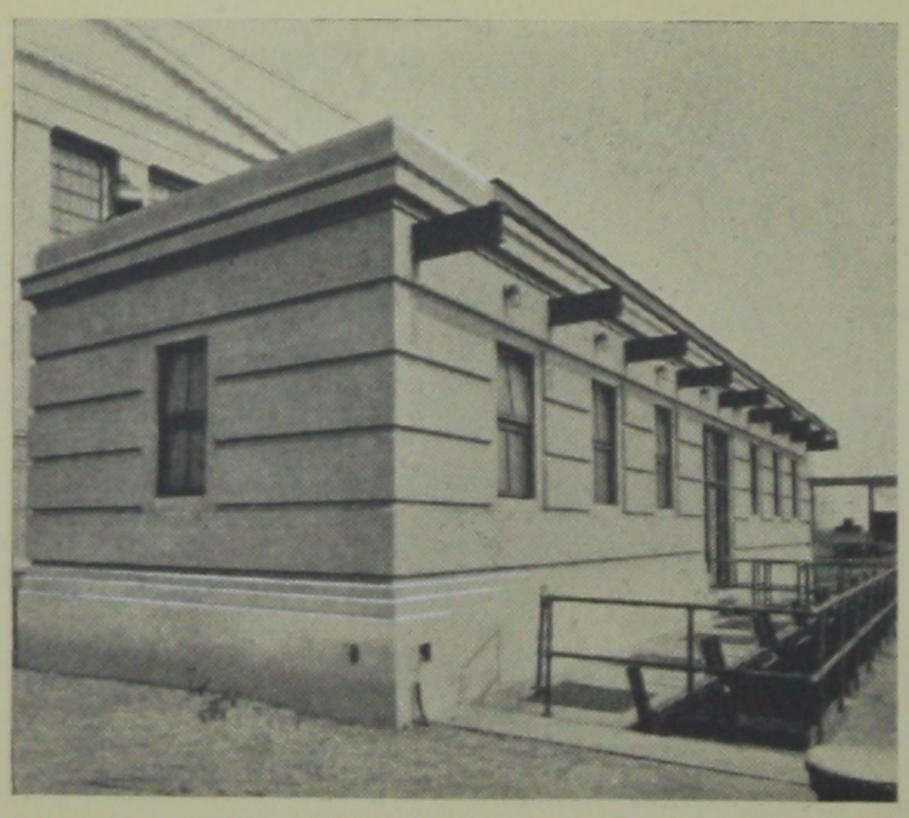
Manufacturing electric current on the tremendous scale necessary to supply Philadelphia and the surrounding territory is an enormous undertaking, as is

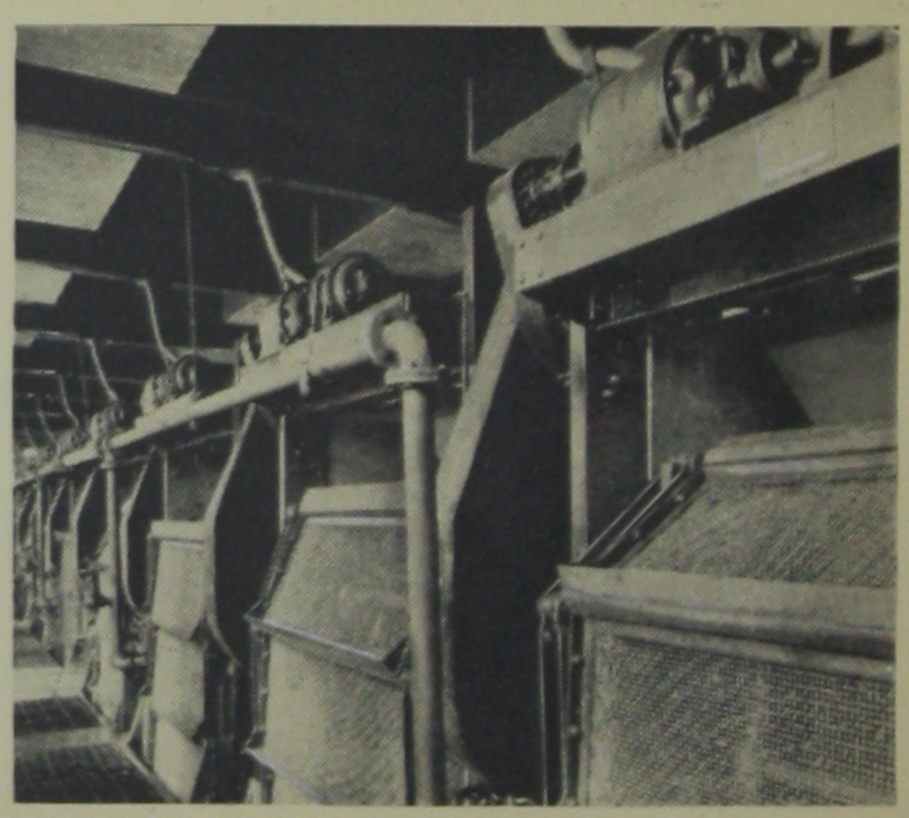




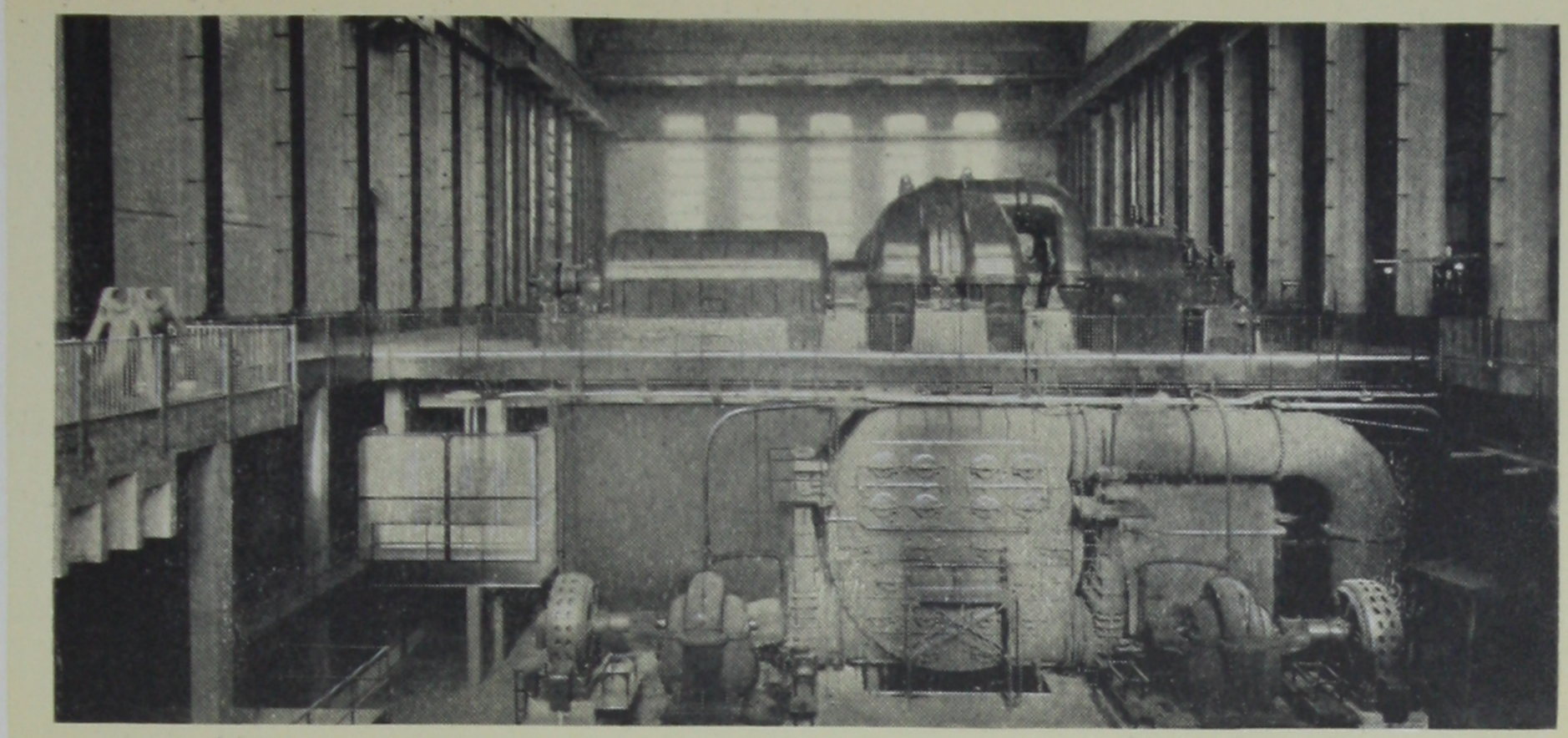
On the floor above the boiler room are the forced and induced draft fans.

evidenced by the scale on which everything is done at Richmond Station. Here we have an insatiable appetite for raw materials. Each boiler uses one hundred tons of coal a day—and there are six boilers for each of the two turbines, making a total of twelve hundred tons of coal per day. Coal is delivered to the plant by means of barges—or railroad cars if necessary—and carried to the top of the coal tower by means of 1½ ton grab buckets. The rapidity with which these coal buckets move is amazing. They drop down like a plummet from the top of the coal tower, grab their ton and a half of coal in a single swift movement and swing back to the top of the coal tower almost as quickly as the eye travels. Each tower can handle 650 tons per hour. The coal is crushed in the tower, carried over belt conveyors to the top of the boiler house where it is dropped





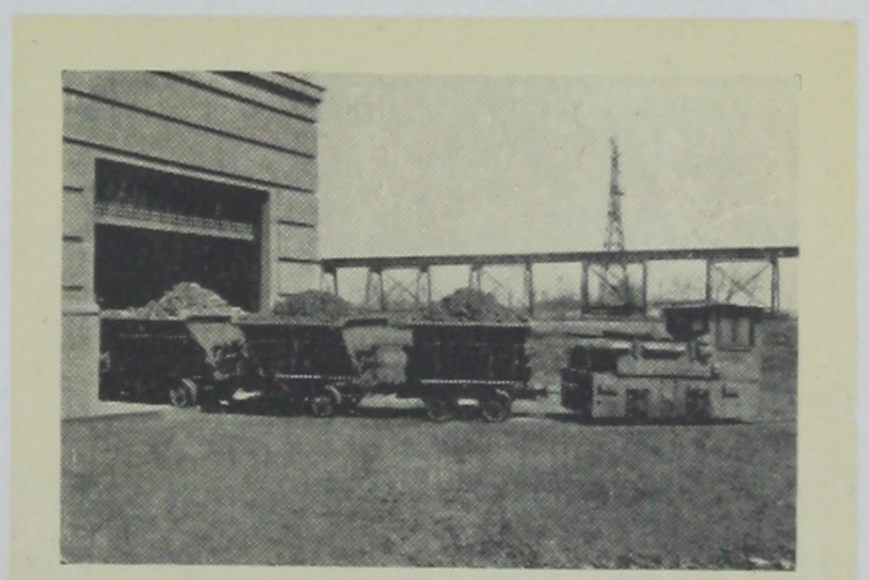
At the left is the screen house—the trash screens eliminate large debris and river flotsam from the water; and the smaller screens inside, shown at the right, screen off the river debris.



A view of one of the turbo-generators with condenser and auxiliary equipment. This is one of the largest condensers in the world—it contains 51½ miles of tubes.

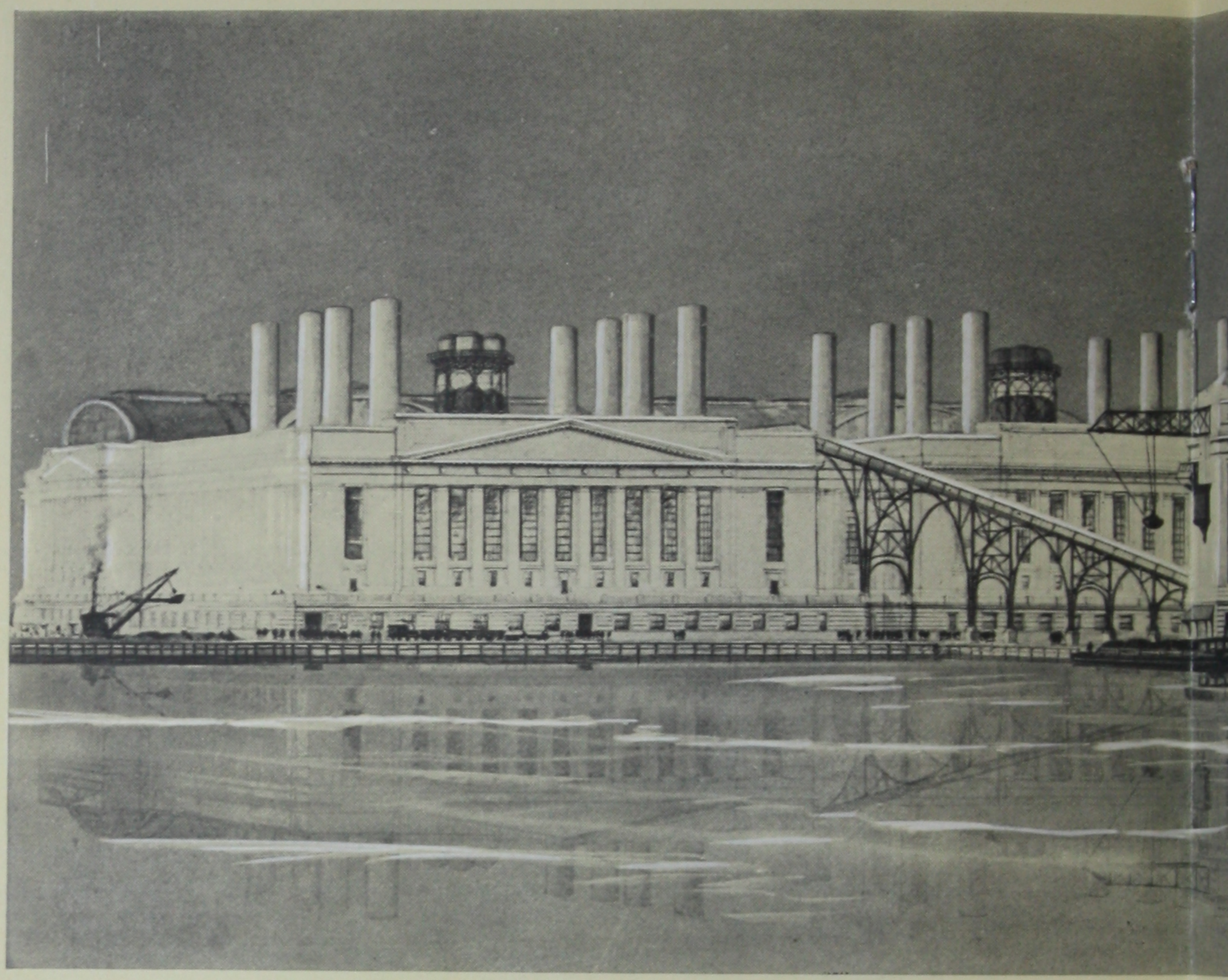
into the bunkers above the boilers. It is not in vain that we have so widely advertised our slogan—"If it isn't electric, it isn't modern"—for the entire coal handling operation is carried on automatically. Human hands or energy have nothing to do with the coal from the time the barge touches the pier until after the ashes are carried away.

As a matter of fact one of the most outstanding features to the layman, of a station such as Richmond, is the insignificant amount of labor necessary, due to the use of automatic machinery wherever possible. Richmond Station operates twenty-four hours a day, three hundred and sixty-five days a year, and yet it uses a force of only about one hundred and twenty men on a three shift basis.



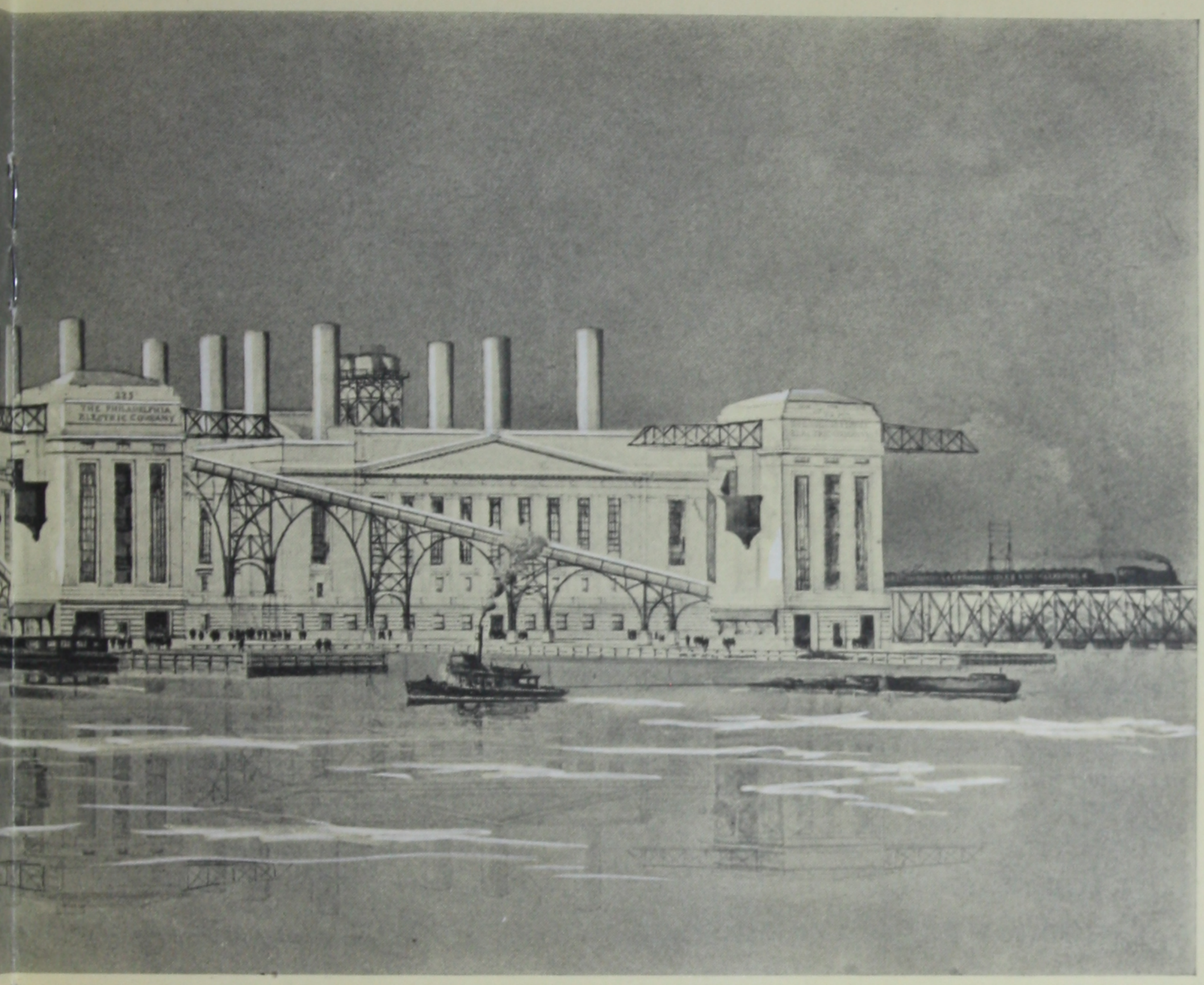
We practice what we preach—here is a little electric locomotive hauling the ash cars out of the station to the storage pit.

Electric stokers feed the coal to the boilers—the number of revolutions per minute of the electric motors determining the



The architect's conception of Richmond Station as it will look from the water-front when completed. Not only a beautiful, i most efficient power p

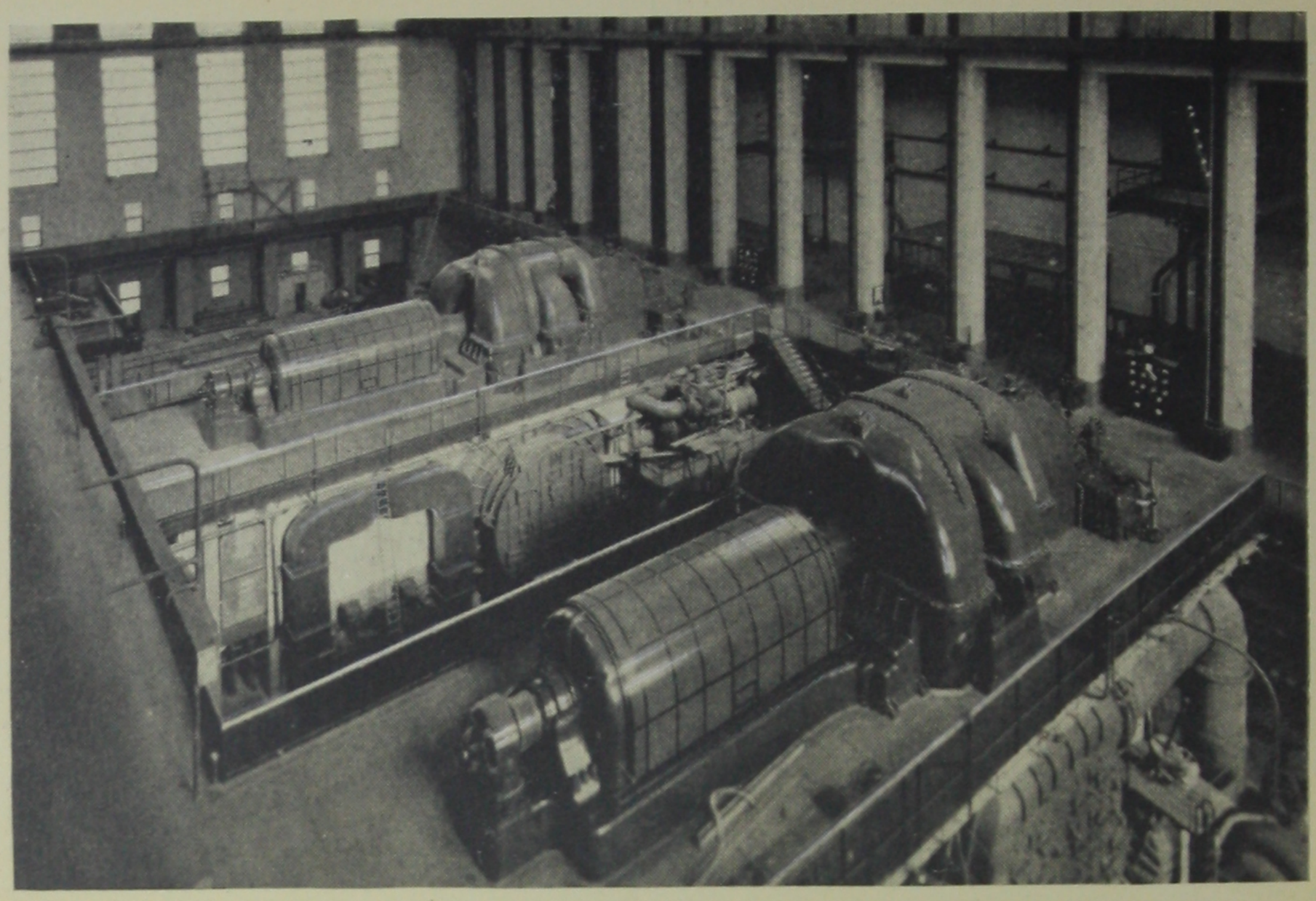
amount of coal to be fed. Delicately adjusted instruments for each boiler accurately record their condition and make possible the attainment of maximum efficiency. The interior of the boiler house is about as different from popular conception of it as is possible. Here are no sweating dirt-begrimed stokers, shoveling coal into the hungry maw of the furnaces until they almost drop of exhaustion—no dark cavernous hole, flooded knee-deep with water and piled with coal, such as the movie directors would have us imagine. It is, instead, an orderly



...iful, imposing building of which Philadelphia may well be proud, but one of the world's largest, most important and ...power plants.

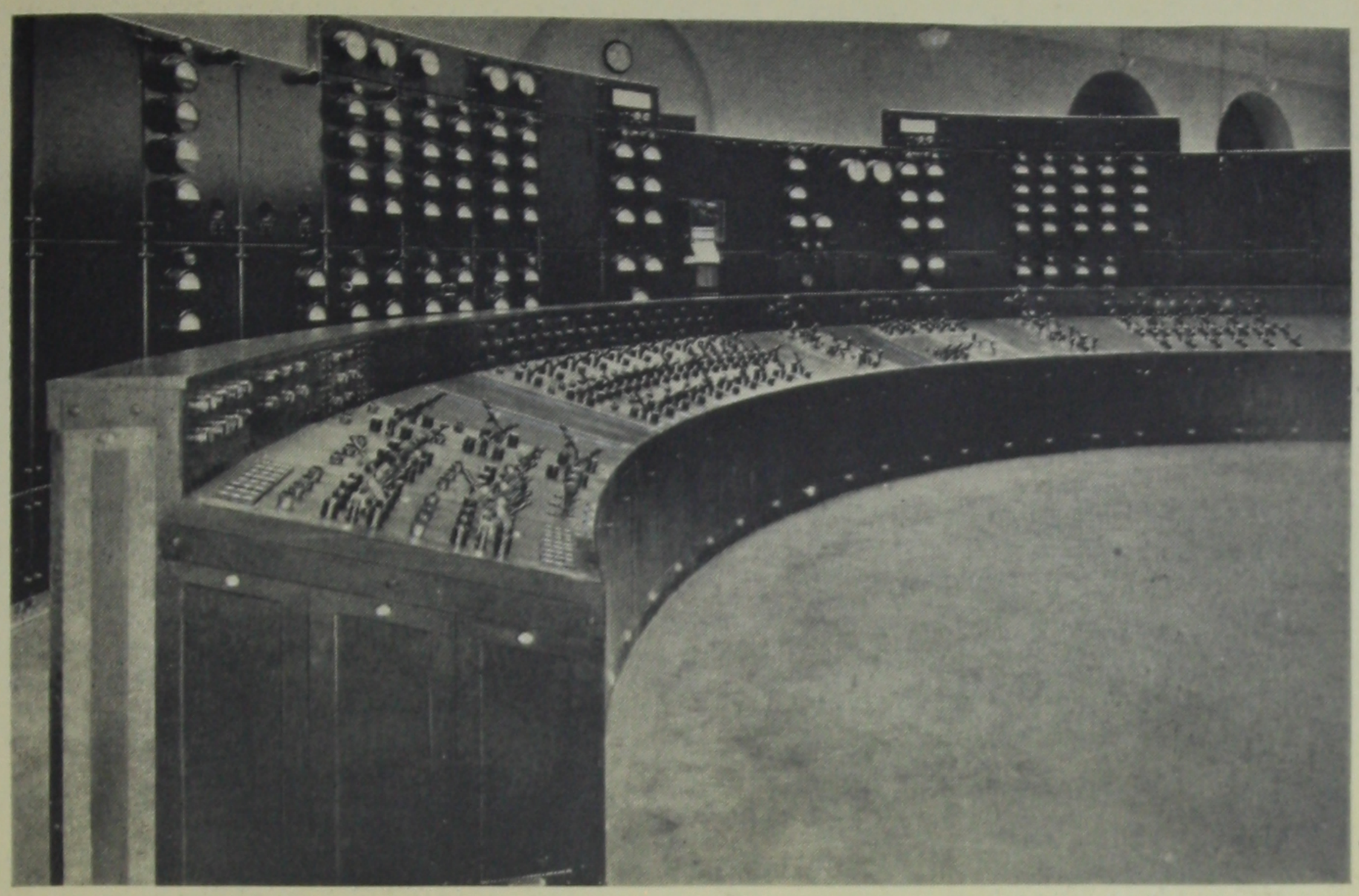
place—clean, efficiently arranged—where a few keen-eyed engineer-operatives keep watch on the instruments and respond to the dispatcher's signals for greater or less pressure.

Each boiler is about the size of a two-story house. Twelve boilers are already installed and working—twelve more are to come. When you stop to consider that the boiler house is only one part of the building and that it is big enough to accommodate the equivalent of twenty-four houses, the vastness of the entire enterprise begins to intrigue the imagination.



"Island" construction is used in Turbine Hall. As you see from the picture, each of the huge turbo-generators, with its auxiliary equipment, is easily available for inspection and service.

This Richmond Station of The Philadelphia Electric Company System is one of the most efficient in the world. That is to say, it produces a kilowatt of electricity at the lowest possible consumption, up to now, of fuel. That is one of the reasons why we have been able to make four voluntary reductions in rates within a period of four years. But it must not be forgotten that only a small part of the cost of electric service is in producing it—the major cost lies in the transmission of current from the station to the customer's premises. The increased efficiency of generating machinery is partly responsible for the increased efficiency in production, of course; but it is interesting to note some of the other factors working toward this end. For example, an artist who did some impressions of the Richmond Station despaired of his artistic effect because he could not picture smoke billowing from the stacks. Of course not!



The "Nerve Center" of the station—the Operating Room. Here is controlled the entire output and operation of the station.

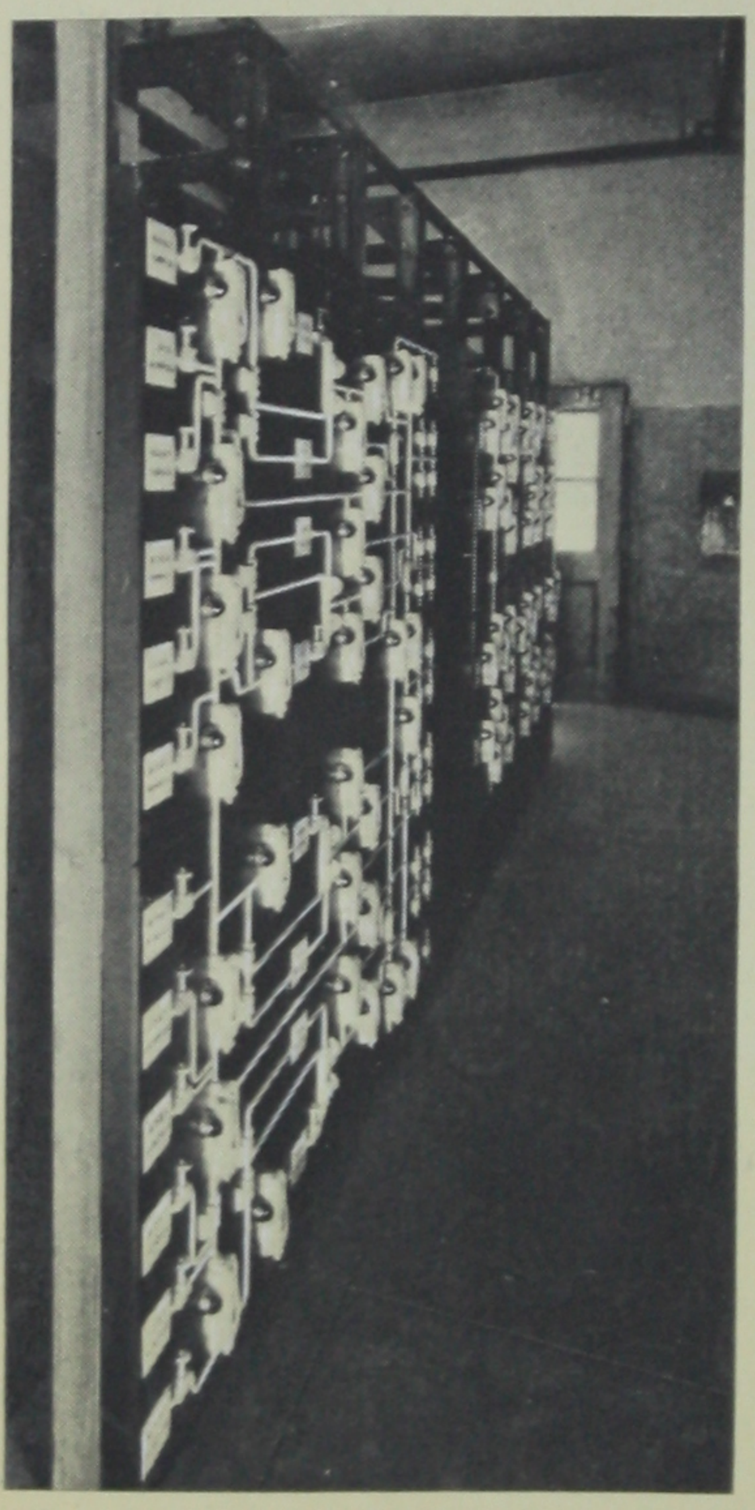
The thin vapor coming out of the stacks is all that is left of the hot air from the boilers, for all of this heat is utilized again in preheating the water for the boilers, thus lessening the fuel consumption. Another major innovation in the Richmond Station in the interests of smaller fuel use is the installation of water cooled side walls and bridge walls in the boilers.

The second of the raw materials used in the manufacture of electricity—air—is supplied by two induced draft fans and one forced draft fan for each boiler. The fans are located on one floor, over the boilers. Semi-automatic damper control has also been installed which automatically maintains the desired draft over the fires.

The ash handling equipment deserves some comment. Ashes are removed by means of clinker grinders at the rear of the stokers and dropped into hoppers beneath each boiler. A narrow-gauge railway passes directly beneath these hoppers—

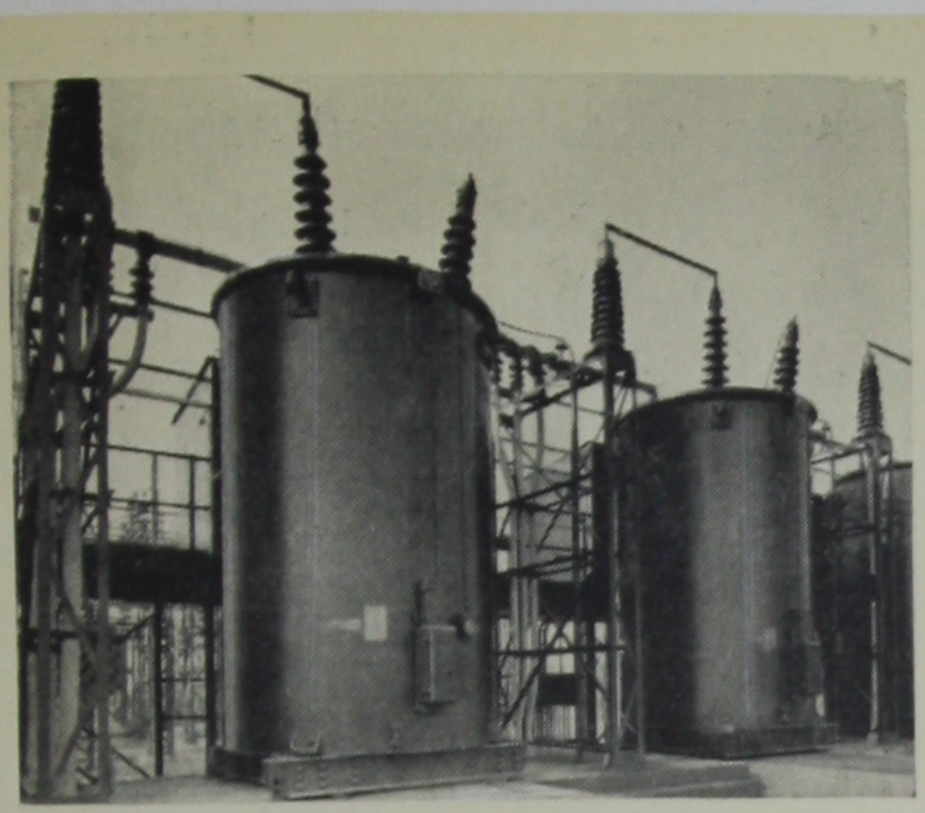
large compressed air gates allow the ashes to be discharged into side dump cars and storage-battery locomotives haul them a short distance to the ash pit along the river front. A locomotive crane in turn deposits them in either barges, railroad cars or trucks for eventual disposal.

The third in our trilogy of raw materials used in the manufacture of electricity is water. If the amount of coal used mounts to astounding figures, then the gallons of water necessary figure to almost unbelievable amounts, because, for every ton of coal used, there must be available four hundred tons of water. This is one reason why it is essential that huge power plants, such as this Richmond Station, absolutely must be located adjacent to adequate water facilities—a condition rarely if ever the case in the coal producing regions. Each turbo-generator requires 78,000 gallons of circulating water per minute. The water is taken in through huge concrete intake tunnels from the Delaware River. It first passes through a series of screens in order that all foreign matter, large and small, is eliminated before the water goes into the condenser. Discharge tunnels complete the cycle of returning the water to the river.



Isolated control board, showing exact layout of all steam lines. In case of emergency, control is maintained here—the mere pushing of a button will turn off all steam if desired.

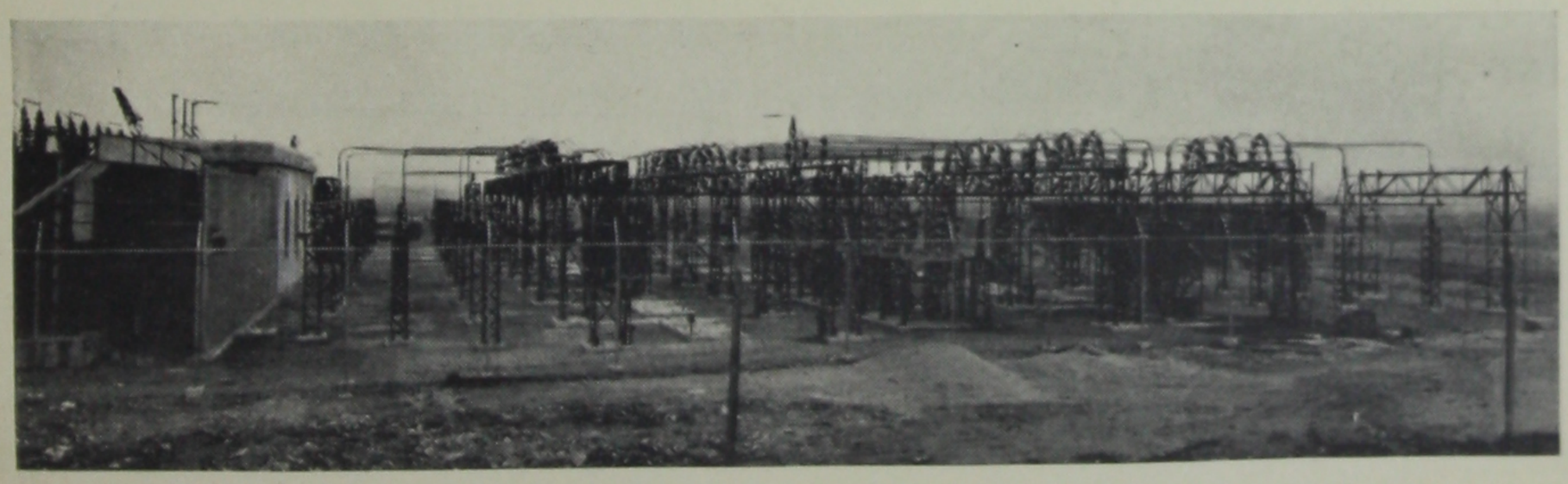
The etching on page five of this book shows Turbine Hall with two 60,000 Kw. turbo-generators installed.



Huge transformers located near the Outdoor Substation—here the electrical energy generated at Richmond is "stepped up."

Impressive as to size, beautiful and dignified as to appearance, efficient as to construction and operation, this Turbine Hall in Richmond Station is most distinctive. It is one of the largest in the world—if not *the* largest—and the two turbines are at present the largest installed anywhere. Looking down into Turbine Hall from the Operating Room, one experiences so much more than the sensation of mere size. This vast pile, housing huge, intricate mechanisms—what does it mean, what will it do? There is an investment here involving many million dollars. Unlike the merchant or storekeeper who turns his capital over two, three, four or more times a year, the public utility can turn its investment over only about once in five years. It, therefore, must use its equipment to the fullest extent.

Back to the button you press or the switch you turn lies the potentialities of these huge turbo-generators in the Turbine



What might be termed the "Shipping" Department of Richmond Station, or the Outdoor Substation. 66,000-volt tie lines will ultimately enable it to send current down into Delaware and up into New Jersey.

Hall of Richmond Station. The mighty hum of industry, the untiring round of street car and electric railroad transportation day in and day out, the countless lights of movies, theatres, hotels and streets, the hundreds of thousands of homes happily and conveniently served—all of them are dependent upon the continuous, reliable and economical performance of this intricate system of machinery. So closely is a central station system interwoven with the fabric of the community's life, that neither can exist without the other.

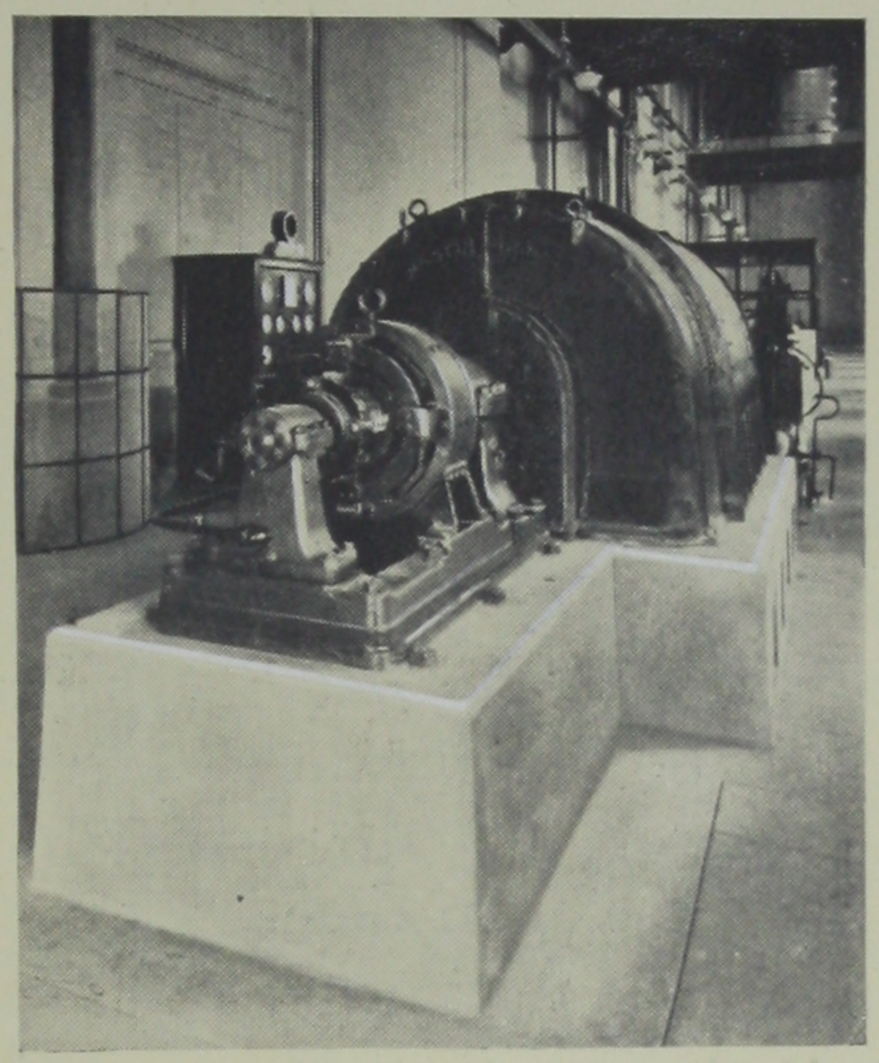
The "nerve center" of the plant is the Operating Room. Located high above the turbine floor, the operating room force controls the entire operation and output of the station. So carefully has this station been designed, both as a station and in its relation to the rest of the system, that any untoward happening in any part of the equipment or control immediately declares itself to the operators. It is an arresting thought, indeed, to realize that the ponderous, complicated mechanism of a vast generating system is adjusted to such nicety that it is as susceptible to easy and quick control as a motor car.

Looking inside of the Kenetron house, showing equipment for the testing of cables. One of the factors to insure reliable and continuous service.

We come now to the third division of Richmond Station, having taken up in turn the Boiler House and Turbine Hall. This is known as the Switch House. The three phases are each located on different floors—the phases being isolated vertically with A-phase on the third floor; B-phase on the

second and C-phase on the first. Operating mechanism is on the ground floor.

As in the case of all manufactured articles, this plant has also a "Shipping Department." A most modern substation of the outdoor type stands at some little distance from the plant itself. All cables leave the station underground; the outdoor "sub" transforms the current —"steps it up"—to the proper voltage and sends it on its way. Richmond Outofdoor Substation is the last word in modern design—it incorporates a number of engineering features which are not only unique, but the last word in efficiency.



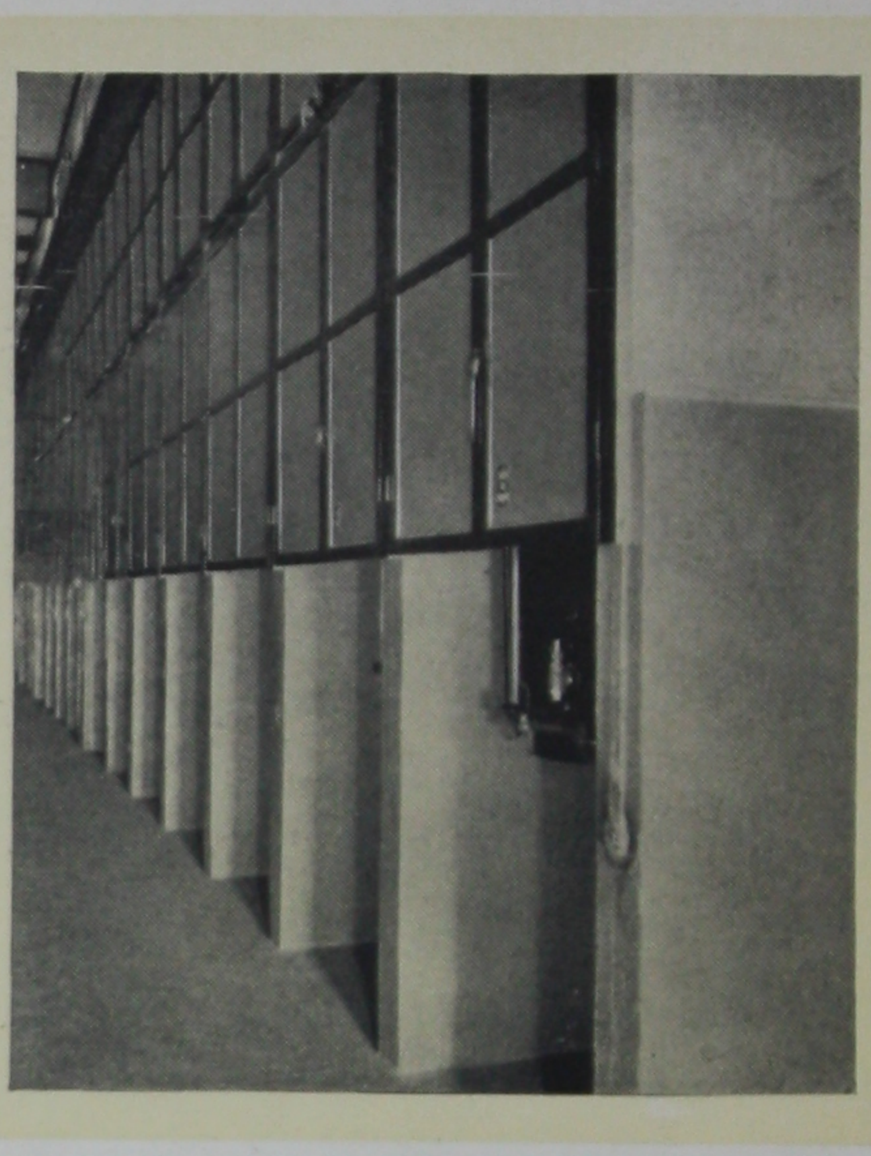
The little 2000 Kw. generator here shown is installed as a reserve source for the station auxiliary power system. In the early days of the Company, a generator of this size was sufficient to handle the entire demand of the community.

It may be taken for granted, of course, that in a power plant of this size and importance, the most precise and detailed attention has been paid to two factors: the insuring of continuous, reliable and economic electric service to the community and the safety of the worker. No detail has been too insignificant to escape attention if it will serve either of these ends; nor has anything been too much trouble. An example of this is the control board in an isolated part of the station, reached only from the outside, on which there is a duplicate layout of the entire steam system of the station. No matter what happens within the station, this section can always be reached and a touch of a button controls the situation.

Located near the outdoor substation, there is a neat little

concrete building known as the Kenetron House. This is another step toward insuring reliable and continuous service. It is obvious that we must, and do, buy the best materials, install them and maintain them in the most efficient manner, but that is not always enough.

The Kenetron cable-testing *forestalls* any interruption of service because of cable faults by showing up possible weaknesses. This unique testing method has been developed to such a point by us that it is now the largest of its kind in the country used by a public utility.



Typical view of floor in switch house. There are three of these—one for each phase. All mechanism is enclosed, and is designed in accordance with the most modern engineering practice.

As the shoreward trains swiftly bear their passengers by Richmond Station, the glimpse of this magnificent new station afforded them tells but little of its place in the economic sun. For here is a super-power plant, strategically located as to efficient coal handling, adequate water supply, demand for power and relation to other super-power plants which are gradually being linked to form a super-power scheme of inter-connection.

It is highly significant that the cost of electricity has *decreased* 8% within the last ten years, while the cost of living as a whole has *increased* 65%. Such a revision downward in face of higher costs of labor and materials could have been accomplished only by providing highly efficient generating stations such as Richmond to insure reliable, efficient and economical electric light and power service for the ever-increasing needs of the community.

INTERESTING FACTS ABOUT RICHMOND STATION

When completed the new Richmond Station will be one of the largest steam generating plants in the world; and will have greater generating capacity than the present installation on the American side of Niagara Falls and greater than Muscle Shoals when that is completed.

The buildings themselves will be the largest in ground area ever built in Philadelphia. The total building frontage on the Delaware River will be 1000 feet, with a depth of 560 feet and a height of 150 feet. The new plant is being built on property which covers 64 acres and which is located on the Delaware River between Lewis Street and Erie Avenue, with a frontage on the river of 3,000 feet. The Pennsylvania Railroad bridge to Atlantic City is just to the north of the property.

The cubic foot content of each section of Richmond Station—there will be three in all—is double that of the Benjamin Franklin Hotel.

Each of the 24 boilers in each section will equal in volume two seven-room houses.

The First Section of Richmond will use when completed, 450 million gallons of water per day—one and a half times as much as the City of Philadelphia uses in the same space of time.

Each smoke stack would allow two seven-passenger motor cars to pass through it side by side.

The generators in the finished station would light four million fifty-watt lamps and these lamps placed 30 feet apart would encircle the earth.

Weight of each of the twelve turbines, 1,400,000 pounds.

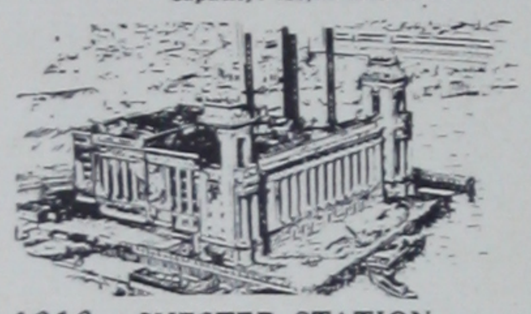
Weight of condenser, without water, 631,500 pounds.

51.5 miles of tubes in each condenser.

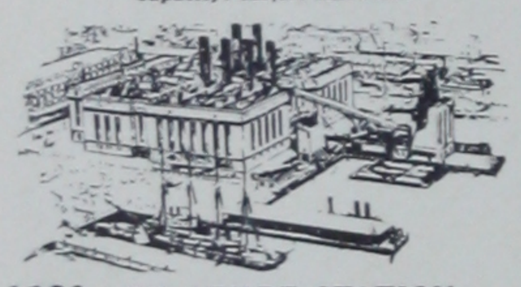
Philadelphia Electric Preparedness Spells Industrial Supremacy for Philadelphia

THE industrial strength of a community is measured by the efficiency of its public utility service. Philadelphia Electric's contribution to Philadelphia's development and our confidence in its future are evidenced in our building program.

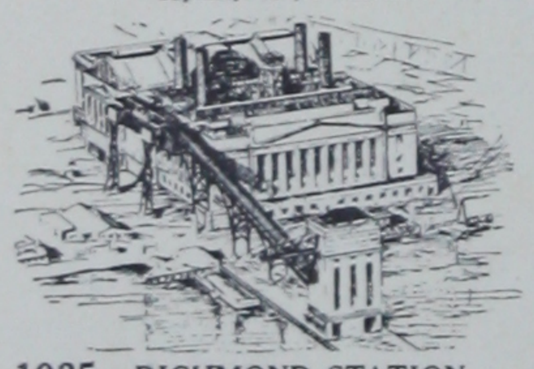
1915—SCHUYLKILL STATION
23d and Christian Streets
Capacity: 156,000 Kilowatts



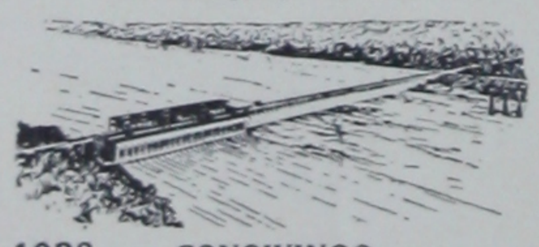
1918—CHESTER STATION
Chester, Pa.
Capacity: 120,000 Kilowatts



1920—DELAWARE STATION
Beach and Palmer Streets
Capacity: 180,000 Kilowatts



1925—RICHMOND STATION
Delaware Avenue and Lewis Street
Ultimate Capacity: 720,000 Kilowatts



1928— CONOWINGO
(Hydro-Electric Power Development)
Conowingo, Md.

WHY?

Why, in the face of the steady upward trend in price of practically every commodity in daily use, can your Electric Company—four times within four years—voluntarily reduce the cost of electric current to its customers, keep up its dividend rates, improve its service, give its employes an annual wage dividend, raise its credit rating to the highest point and see its securities quoted many points above par?

BECAUSE!

1. *Because* unceasing Company organization activities have resulted in a customer-confidence and a rapidly increasing volume and density in use of electrical energy which, in turn, has largely contributed to these voluntary and substantial decreases in rates.

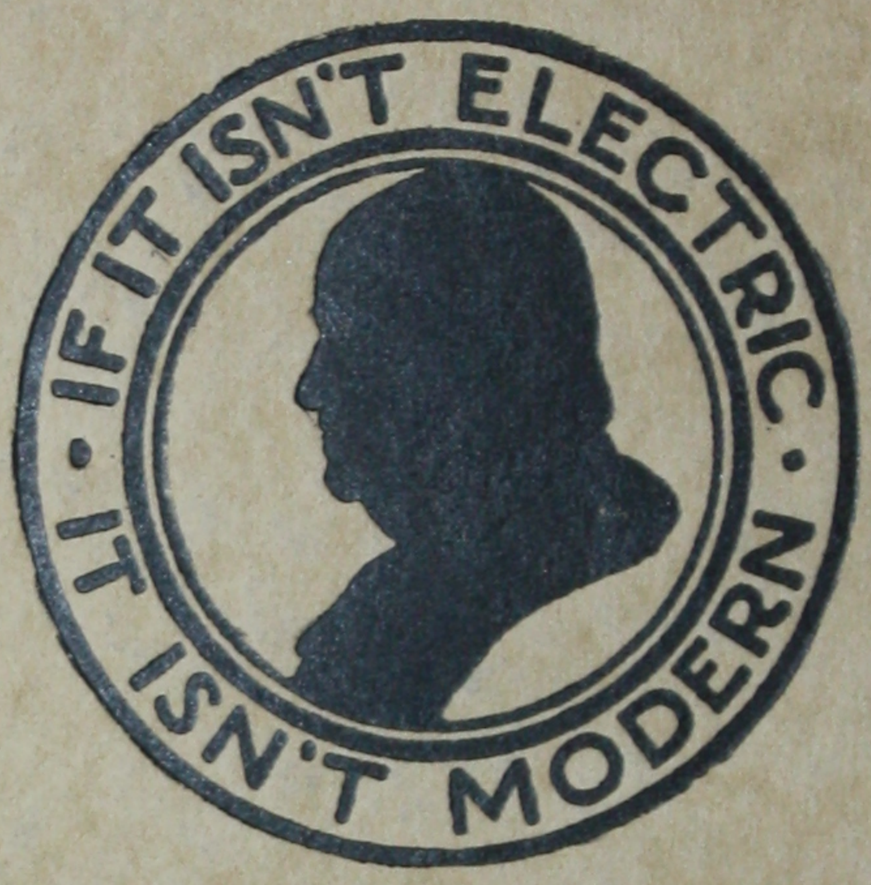
2. *Because* of the efficiency of its Executive Management, which includes a co-operative Board of Directors, always a step in advance of the community's requirements, knowing how, when and where to obtain, at reasonable cost, the tremendous capital required for constant expansion.

3. *Because* of the efficiency of Commercial Management, which knows how to develop business through the education of the public in what can be accomplished by the use of electricity, and after developing that business, knowing how to keep it by continually furnishing the highest type of commercial service.

4. *Because* of efficiency of Engineering Management, which knows how, when and where to build great central power generating stations, with the entire network of transmission lines, substations and distributing lines, thus insuring reliability and the highest type of engineering service.

The

PHILADELPHIA ELECTRIC CO. SYSTEM


IF IT ISN'T ELECTRIC · IT ISN'T MODERN ·

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